Claims

1. A photovoltaic device, comprising a composition of carbon nanotubes and of at least one organic compound acting as a hole conductor.

2. The device according to claim 1, characterized in that it further comprises

   - a first electrode on one side of said composition of carbon nanotubes and of at least one hole conductor, said first electrode having a first work function, and
   - a second electrode on another side of said composition of carbon nanotubes and of at least one hole conductor, said second electrode having a higher work function than said first work function.

3. The device according to any of the foregoing claims, characterized in that said at least one hole conductor is a conjugated polymer or a blend of at least two conjugated polymers.

4. The device according to any of the foregoing claims, characterized in that said carbon nanotubes are a mixture of metallic and semiconducting carbon nanotubes, preferably only semiconducting carbon nanotubes.

5. The device according to any of the foregoing claims, characterized in that said carbon nanotubes are a mixture of multi-walled and single-walled carbon nanotubes, preferably only single-walled carbon nanotubes.

6. The device according to any of the foregoing claims, characterized in that the carbon nanotubes have a diameter in the range of from 0.5 nm to 2 nm.

7. The device according to any of the foregoing claims, characterized in that the band gap of said carbon nanotubes lies in the range of from about 0.5 to about 1 eV.

8. The device according to any of the foregoing claims, characterized in that the band gap of said at least one hole conductor lies in the range of from about 1 eV to 3 eV, preferably from about 1.5 eV to 2.5 eV, more preferably from about 1.75 eV to 2.25 eV.

9. The device according to any of the foregoing claims, characterized in that said hole conductor is selected from the group comprising semiconducting organic materials with a band gap above 1 eV and a π-orbital higher in energy than the highest occupied molecular orbital (HOMO) of said carbon nanotubes.

10. The device according to any of the foregoing claims, characterized in that said composition of carbon nanotubes and of at least one organic hole conductor comprises a mixture of carbon nanotubes and at least one hole conductor.

11. The device according to any of claims 1 – 9, characterized in that said composition is a two-layer-system, wherein said at least one hole conductor is in one layer and said carbon nanotubes are in another layer.

12. The device according to any of claims 1 – 9, characterized in that said composition is a multiple-layer-system, wherein said at least one hole conductor and said carbon nanotubes are in alternating layers.

13. The device according to any of claims 2-12, characterized in that said carbon nanotubes have been vertically grown, preferably on one of said electrodes.

14. The device according to any of claims 2-13, characterized in that a hole conductor is directly grown on said carbon nanotubes ("overgrown nanotubes").

15. The device according to any of claims 2 – 12 and 14, characterized in that said carbon nanotubes have been horizontally aligned, preferably on one of said electrodes.

16. The device according to any of the foregoing claims, characterized in that said at least one hole conductor is selected from the group comprising
polymethacrylates and derivatives, e.g. bis(diarylamino)biphenyl functionalised methacrylates and copolymers thereof,

polyaniline and derivatives,
polyphenylene and derivatives,
polyphenylene vinylene and derivatives, e.g. poly(2-methoxy, 5-(3', 7'-dimethyloctyloxy)-1,4-phenylene vinylene (MDMO-PPV),
polythiophene and derivatives,
copolymers of triphenyl diamine derivatives and trimethoxyvinylsilane,
poly(3,4-ethylenedioxythiophene: polystyrene sulfonic acid) (PEDOT:PSS),
polyacetylene and derivatives thereof,
polyparaphenylene and derivatives thereof,
polypyrrole and derivatives thereof,
polyparaphenylene sulfide and derivatives thereof,
polycarbazole and derivatives thereof,
polyisothianaphene and derivatives thereof,
poly(1,6-heptadiyne) and derivatives thereof, and
polyquinoline and derivatives thereof

17. The device according to any of claims 1 – 16, characterized in that it is an organic solar cell.

18. The device according to any of claims 2 – 17, characterized in that said first and/or said second electrode is a film or layer of a transparent material.

19. The device according to any of claims 2 – 18, characterized in that said first or second electrode is a metallic electrode.

20. The device according to any of claims 2-19, characterized in that said first and/or said second electrode is coated with an evaporated layer of fluoride or acetate, e.g. LiF, CsF, CH_3COOLi, or a combination of fluoride and acetate.

21. The device according to any of claims 18 – 20, characterized in that it additionally comprises a solid inorganic crystalline or glassy substrate, or a metal foil substrate, preferably a stainless steel foil substrate, or a polymer substrate pre-coated with said first or said second electrode.

22. The device according to any of claims 18 – 20, characterized in that it additionally comprises a flexible polymer substrate pre-coated with said first or said second electrode.

23. A combination of the device according to any of the foregoing claims with a circuit, wherein the device according to any of the foregoing claims acts as an internal power supply.

24. Use of the device according to any of claims 1 – 22 as a solar cell.

25. A method of generating electricity from light, characterized in that a device according to any of claims 1 – 22 or a combination according to claim 23 is irradiated by light, whereupon a photo-initiated charge-separation process and subsequently a charge-transport process occurs, and wherein further electricity is recovered from said device or from said combination.